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TWO NEW SPECIES OF *BOTOCUDO* FROM VERTICAL ROCK FACES IN INDONESIA (HEMIPTERA: LYGAEIDAE)

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Abstract.—*Botocudo hebrodes* and *Botocudo polhemusi* are described as new species from Bacan Island, Indonesia. Both species were taken living together on vertical rock faces adjacent to a flowing river near the coastal plain. The habitat was that usually occupied by species of Hebridae. A discussion of possible feeding habits and of the occurrence of other lygaeids that are known to live on vertical rock faces is included. Figures include a dorsal view and details of the abdomen and of the male genitalia.

Detricolous lygaeids in the wet tropics often must adopt unusual strategies for survival because the mature seeds upon which they feed usually either germinate quickly or are attacked by fungi once they have reached the ground. Thus we find species, in genera whose members are usually ground litter bugs, feeding on seeds in bird droppings on leaves, on seeds in bat guano in caves, and especially upon plants that retain mature seeds on the plants for a considerable period of time.

Recently the junior author and his father discovered the lygaeids described in this paper living in a most unusual habitat on the island of Bacan in Indonesia (Bacan is the current Indonesian name for the island that in most past biographic and systematic papers has been called Batchian). It is just west of the large island of Halmahera. One of the most effective methods of collecting many species of Hebridae and Veliidae is to splash water upon vertical rock faces to wash the insects into a net held below. On September 23, 1985, the junior author and his father were using this technique on Bacan Island in the hope of obtaining specimens of Hebridae. The site was at less than 100 meters elevation just at the point where the narrow coastal plain with its coconut plantations meets the first forested outliers of the Gunung Sabela massif. Here a swift shallow river flows through a narrow gap between large rock outcrops. The vertical outcrops are of a tan sedimentary rock (probably sandstone) and are partially shaded by disturbed primary rain forest. From these rocks the collecting party washed down a series of tiny insects that they thought were unusual looking hebrids or veliids since they occupied a typical hebrid/veliid habitat on the rocks just above the water line. It is of great interest that not only did the insects prove to be antillocorine lygaeids of the genus *Botocudo,* but that two closely related species were present and that hebrids were absent. The absence of Hebridae (small Veliidae were present) is in itself unusual since they did occur on the mountain at 350 meters.

The presence of the lygaeids in such an unusual habitat and the absence of Hebridae raised several interesting questions. What were the lygaeids feeding on? Were they competitively excluding the Hebridae?

What was their relationship to the veliids and were the two lygaeid species in direct competition with each other? While no definite answers can be given, some probabilities can. First, the lygaeid species show no morphological modifications that suggest an adaptation to the unusual habitat, nor to any modification in their feeding habits. All members of the tribe to which these lygaeids belong (including several congeneric species) feed on mature seeds of angiosperms. While the collecting party did not see any signs of vegetation on the rock face it is highly probable that the tiny insects were feeding either on minute seeds falling from the vegetation above or upon seeds continually being washed against the sides of the stream. The presence of numerous adults but no nymphs suggests the exploitation of a temporary food source.

While Lygaeidae living on vertical rock faces is most unusual it is not unprecedented. Baranowski and Slater (in press) describe a new genus and species of antillocorine from Trinidad that feeds upon the seeds of *Pilea microphylla* (L.) Liebm. that grows on the vertical rock or concrete surfaces of culverts, bridges and in rocky areas near streams and waterfalls. These authors collected this species together with a member of the *Ozophora pallescens* complex and a species of *Botocudo* by placing a net below the *Pilea* plants on the vertical faces and brushing the insects into the net held below.

The senior author of the present paper also took a long series of a species of *Botocudo* running over rocks in a dry stream bed at El Valle, Panama, during the dry season. These small antillocorine lygaeids, species of which also inhabit caves (Slater, 1984), thus appear to be, at least in part, opportunists that rapidly move in to exploit a seed crop. We conclude that the Bacan Island species are probably not predatory and thus would not be in competition with Hebridae. On the other hand, they might well be prey items of the associated Veliidae.

That two very closely related species of *Botocudo* were taken also suggests the exploitation of a temporary seed source. It is difficult to believe that if both species were primarily adapted to living on these vertical rock faces that they would not be in direct competition with one another. Both species are similar in size, shape and color and have mouth parts of approximately the same length. It is not unusual for closely related seed feeding lygaeids to be found together (even as breeding assemblages) but when this occurs it always appears to involve an abundant and temporary food source. Many species of *Stilbocoris* in Africa and *Ozophora* in the Neotropics are striking examples.

Relationship of the Lygaeid Species

As noted above neither of the *Botocudo* species described below shows any unusual morphological adaptations. The abdominal spiracle and trichobothrial patterns are found in many other species of the genus. The sperm reservoir (Fig. 2) is generalized. The genus *Botocudo* may not be a monophyletic taxon as presently delimited but these two species are certainly part of a monophyletic group of species which is found in the Orient, Australia, and the Neotropics.

All measurements are given in mm. CL numbers following locality data refer to codes used by the junior author to reference ecological notes.

Botocudo hebrodes Slater and D. Polhemus, New Species

Body elliptical (Fig.1). Head dull red. Pronotum and scutellum with ground color chocolate brown. Pronotum marked with yellow as follows: a transverse stripe along anterior margin from meson laterad to inner edge of compound eye; an irregular macula near center of pronotum; extreme humeral

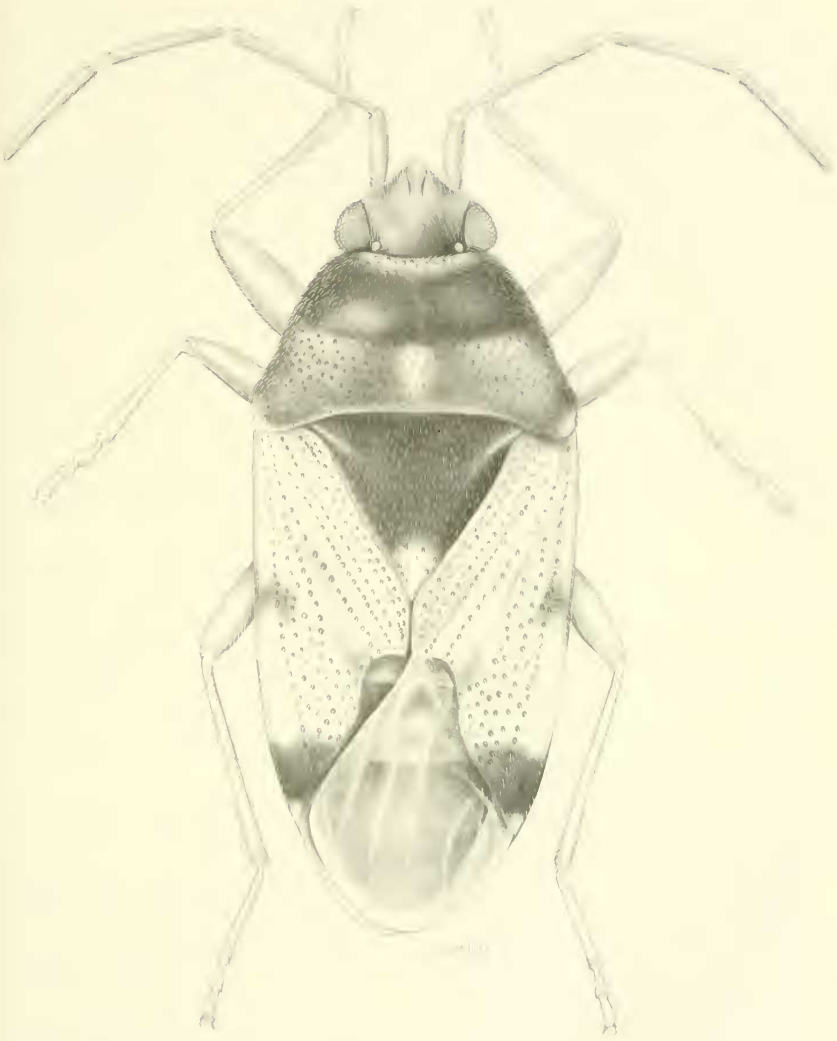


Fig. 1. *Botocudo hebrodes*, dorsal view.

angles. A large diffuse reddish brown macula present behind dark calli. Extreme posterior margin of pronotum pale. Posterior one-third of scutellum white. Hemelytra white or very pale yellow with strongly contrasting dark brown punctures. Corium with three dark brown maculae, one along lateral margin at level of apex of scutellum, a small one along apical corial margin at place of maximum concavity of margin and a large subapical macula covering entire distal portion of corium. Membrane uniformly hyaline. Lateral and ventral surfaces dark chocolate brown. Legs (including femora) and antennae pale yellow. Proximal one-third to one-half of third antennal segment reddish brown.

Head subshining, pronotum and scutellum somewhat pruinose, evenly and conspicuously punctate. Dorsal surface thickly clothed with short conspicuous upright silvery hairs.

Head moderately declivent anteriorly. Tylus extending to middle of first antennal segment. Vertex convex, eyes large and sessile. Length head 0.46, width 1.24, interocular space 0.34.

Pronotum lacking a well defined anterior collar and without a transverse impression. Anterior pronotal lobe not strongly convex. Lateral margins of pronotum calloused but not sharply carinate, strongly and almost evenly narrowing from humeral angles to anterior margin. Length pronotum 0.60, width 1.20.

Scutellum lacking a median carina. Length scutellum 0.74, width 0.74. Clavus with three rows of punctures. Length claval commissure 0.20. Lateral corial margins evenly narrowing posteriorly, not sinuate. Midline distance apex clavus-apex corium 0.62. Midline distance apex corium-apex abdomen 0.48.

Metathoracic scent gland auricle strongly bent posteriorly. Evaporative area small, forming an arc around auricle, with outer margin rounded not covering posterior lobe of metapleuron.

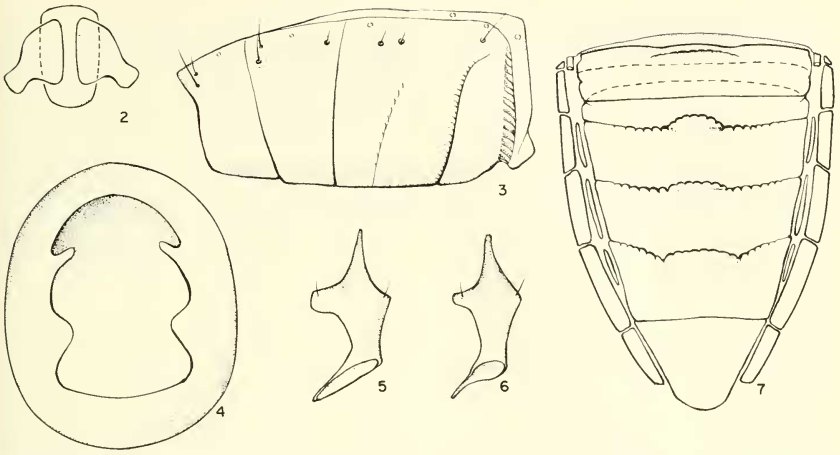
Fore femur with four very small spines ventrally on distal half (appearing mutic in most views) plus a row of close set spinules running entire length on inner ventral surface of femur. Labium reaching between mesocoxae. Length labial segments I 0.28, II 0.42, III 0.24, IV 0.22. Gular trough elongate, extending entire ventral length of head. Antennae slender, terete, fourth segment not thickened nor markedly fusiform. Length antennal segments I 0.32, II 0.62, III 0.52, IV 0.56. Total body length 2.92.

Abdomen with well-developed scent gland scars between terga 3–4, 4–5, and 5–6, that between 5 and 6 the largest. Inner laterotergites present on segments 4, 5, and 6 (Fig. 7). Spiracles 2 and 4 located on sternal shelf, those on segments 3 and 5 below shelf (Fig. 3). Trichobothria of sterna 4 and 5 arranged in a linear row, two posterior trichobothria both anterior to spiracle 5 (Fig. 3). Paramere (Fig. 6) very small, trianguloid, and with a short distally rounded thumb-like posterior projection. Sperm reservoir as in *polhemusi*. Opening of genital capsule as in Fig. 4.

Holotype: ♂. INDONESIA: *Bacan Is.*: Maluku Province, Kab. Maluku Utara., swift shallow river 3 Km. S. of Labuha nr police station. 50–100 M. 23.IX.11985 (CL2134) (J. T. and D. A. Polhemus). In National Museum of Natural History (USNM). Type No. 100060.

Paratypes: 7 ♂, 14 ♀, same data as holotype. In J. A. Slater and J. Polhemus collections.

This species is readily separable from all known species in the Eastern Hemisphere. China (1930) notes that *Botocudo swezeyi* from Samoa is readily distinguished from all other species by the uniformly red-brown pronotum and scutellum. This is not strictly true if the entire Oriental and Australian fauna is considered. It is true that many of the *Botocudo* species do have a bicolored pronotum (*longicornis* Barber; *flavicornis* Signoret; *yasumatsui, japonicus,* and *formosanus* Hidaka; *assimulans* Bergroth; *patricius, signandus,* and *fraternus* Distant). From the remaining described species *hebrodes* differs as follows; *swezeyi* China has



Figs. 2–7. *Botocudo* spp. 2, *B. polhemusi,* sperm reservoir, dorsal view. 3, *B. hebrodes,* abdomen, lateral view. 4, *B. hebrodes,* genital capsule, dorsal view. 5, *B. polhemusi,* paramere. 6, *B. hebrodes,* paramere. 7, *B. hebrodes,* abdomen, dorsal view.

a dark fuscous brown fourth antennal segment; *marianensis* Usinger has a pale v-shaped mark on the scutellum, or (var. *scutellatus*) the entire posterior one-half of the scutellum is yellow; *rennellensis* Scudder also has the distal one-half of the scutellum pale yellow and has the entire distal one-half of the corium and the end of the clavus dark brown; *validulus* Bergroth has the first antennal segment almost as long as segment three and apparently has only the apex of the corium with a dark macula; *pronotalis* has the entire pronotum yellow; *scudderi* has a similar corial coloration as *hebrodes* but a shining rather than hirsute and more sub-quadrate shaped pronotum and dark brown femora.

Botocudo polhemusi
Slater and D. Polhemus, New Species

Very similar to *Botocudo hebrodes* in size and general coloration. Pronotum entirely dark, anterior collar narrowly reddish brown. Apical white macula occupying entire distal one-third of scutellum (with exception of marginal punctures) and sharply truncate across anterior end. Dark hemelytral maculae midway along costal margin and adjacent to concave region of apical corial margin larger than in *hebrodes.* All femora reddish brown becoming paler distally. Tibiae, tarsi, antennae, and labium pale yellow. Dorsal body surface nearly glabrous, pronotum lacking a dense covering of distinct upstanding hairs.

Tylus attaining middle of first antennal segment. Vertex convex. Length head 0.34, width 0.58, interocular space 0.30. Anterior pronotal lobe appreciably swollen above posterior lobe and evenly so across middle. Anterior collar area narrow and well defined posteriorly by a line of coarse punctures. Lateral pronotal margins sinuate, obtusely calloused; posterior margin concave. Length pronotum 0.58, width 1.04. Length scutellum 0.60, width 0.64. Hemelytral shape as in *hebrodes.* Length claval commissure 0.16. Midline distance apex clavus-apex corium 0.50. Midline distance apex corium-apex membrane 0.42. Metathoracic scent gland auricle, fore femora and evaporative area as in *hebrodes.* Labium barely attaining anterior margin of mesocoxae. Length labial segments I 0.22, II 0.30, III 0.18, IV 0.18.

Antennae relatively short and stout, segment II enlarged at distal end, segments III and IV fusiform. Length antennal segments I 0.30, II 0.40, III 0.34, IV 0.44. Total body length 2.52.

Sperm reservoir with conventionally shaped elliptical cup and large wings that curve posteriorly to end in distal enlargement (Fig. 2). No evident holding sclerites. Vesica with three prominent coils and a well developed helicoid process. Paramere very small, blade straight and tapered to a sharp point; posterior projection elongately protruding and truncate at distal end (Fig. 5). Abdominal segmentation, placement of trichobothria, spiracles and shape of opening of genital capsule as in *hebrodes*.

Holotype: ♂. INDONESIA: *Bacan I.* Maluku Province, Kab. Maluku Utara., swift shallow river 3 Km S. of Labuha nr. police station. 50–100 M. 23.IX.1985 (CL2134) (J. T. and D. A. Polhemus). In National Museum of Natural History (USNM). Type No. 100061.

Paratypes: 3 ♂, 1 ♀. Same data as holotype. In J. A. Slater and J. Polhemus collections.

We are pleased to name this species for John Polhemus in recognition of his many contributions to Hemipterology.

It is remarkable that two such similar and apparently closely related species should be taken together in the same unusual habitat. *Botocudo polhemusi* may be distinguished from *hebrodes* by the much more swollen anterior pronotal lobe; by the lack of a dense clothing of upright hairs on the surface of the pronotum and scutellum and by the relatively much shorter antennal segments. This can be expressed by the ratio of the second antennal segment to the interocular space. In *hebrodes* the second antennal segment is always considerably more than one and one-half times the interocular distance, mean 1.73 (n = 5), whereas in *polhemusi* the mean is 1.40 (n = 4) and there is no overlap in the ratios. A glance at the measurements of the holotypes will clearly show that the third and fourth antennal segments are also much shorter in *polhemusi* than they are in *hebrodes*. The paramere of *polhemusi* has a longer and more truncated posterior projection (Fig. 5) than does that of *hebrodes* (Fig. 6). In addition to these structural differences there are color differences that will separate the two species. *B. hebrodes* (Fig. 1) has considerable pale coloration on the pronotum, the white apical scutellar macula has an irregular anterior margin and the femora are uniformly pale yellow. In *polhemusi* the pronotum is uniformly dark, the anterior margin of the white scutellar macula is evenly truncate and the femora are for the most part reddish brown.

Botocudo scudderi Slater (described from Ceylon) is apparently a member of this complex and agrees with *polhemusi* in having brown femora and a non-hirsute pronotum and scutellum. However, *scudderi* may readily be separated by its uniformly polished and shining dorsal body surface, dark brown antennae, small non-truncated white scutellar spot, less elevated anterior pronotal lobe and evenly convex, non-sinuate lateral pronotal margins.

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